What is claimed is:

1. A process for forming a metal damascene structure, comprising the following steps:

forming a dielectric layer on a substrate;

etching the dielectric layer to form a damascene opening;

providing a plasma treatment to remove remaining impurities on the dielectric layer; and

filling a metal in the damascene opening.

2. The process as claimed in claim 1, wherein the plasma treatment uses a hydrogen-containing plasma, a nitrogen-containing plasma, an oxygen-containing plasma, or mixtures thereof.

3. The process as claimed in claim 2, wherein the hydrogen-containing plasma is hydrogen (H_2) plasma or ammonia (NH_3) plasma.

4. The process as claimed in claim 2, wherein the nitrogen-containing plasma is nitrogen (N_2) plasma or ammonia (NH_3) plasma.

5. The process as claimed in claim 2, wherein the oxygen-containing plasma is N_2O plasma or oxygen (O_2) plasma.

6. The process as claimed in claim 2, where the plasma treatment step uses H_2 plasma, NH_3 plasma, H_2/NH_3 plasma, or H_2/N_2 plasma.

7. The process as claimed in claim 1, wherein the damascene opening is a via.

8. The process as claimed in claim 7, wherein the damascene opening further comprises a trench above the via.

9. The process as claimed in claim 8, wherein the metal filling step includes filling copper or copper alloy in the trench and the via.

10. The process as claimed in claim 1, before the dielectric layer is formed, further comprising forming a first metal layer on the substrate.

11. The process as claimed in claim 10, wherein the first metal layer is copper or copper alloy.

12. The process as claimed in claim 11, wherein the plasma treatment is performed on the surface of the first metal layer.

13. The process as claimed in claim 12, wherein the plasma treatment removes remaining impurities on the first metal layer.

14. The process as claimed in claim 12, wherein the plasma treatment repairs the bonding between the first metal layer and the dielectric layer.

15. The process as claimed in claim 10, after the first metal layer is formed and before the dielectric

layer is formed, further comprising forming a cap layer on the first metal layer.

16. The process as claimed in claim 15, wherein the cap layer is nitride or silicon carbide.

17. The process as claimed in claim 15, wherein the plasma treatment repairs the bonding between the first metal layer and the cap layer.

18. A process for forming a metal damascene structure, comprising the following steps:

forming a cap layer on a first metal layer;

forming a dielectric layer on the cap layer;

etching the dielectric layer with fluorine-containing plasma or chlorine-containing plasma to form a damascene opening;

plasma treating using a hydrogen-containing plasma; and

filling a metal in the damascene opening.

19. The process as claimed in claim 18, wherein the hydrogen-containing plasma is hydrogen (H_2) plasma or ammonia (NH_3) plasma.

20. The process as claimed in claim 18, wherein the plasma treatment step uses H_2 plasma, NH_3 plasma, H_2/NH_3 plasma, or H_2/N_2 plasma.

21. The process as claimed in claim 18, wherein the damascene opening is a via.

22. The process as claimed in claim 21, wherein the damascene opening further comprises a trench above the via.

23. The process as claimed in claim 22, wherein the metal filling step includes filling copper or copper alloy in the trench and the via.

24. The process as claimed in claim 18, wherein the first metal layer is copper or copper alloy.

25. The process as claimed in claim 18, wherein the cap layer is nitride or silicon carbide.

26. A process for forming a metal damascene structure, comprising the following steps:

forming a cap layer on a first metal layer, wherein the cap layer is a nitride layer;

forming a dielectric layer on the cap layer;

etching the dielectric layer to form a damascene opening;

plasma treating using a nitrogen-containing plasma; and

filling a metal in the damascene opening.

27. The process as claimed in claim 26, wherein the etching step uses fluorine-containing plasma or chlorine-containing plasma.

28. The process as claimed in claim 26, wherein the nitrogen-containing plasma is nitrogen (N_2) plasma.

29. The process as claimed in claim 26, wherein the plasma treatment step uses NH_3 plasma, N_2 plasma, H_2/NH_3 plasma, or H_2/N_2 plasma.

30. The process as claimed in claim 26, wherein the damascene opening is a via.

31. The process as claimed in claim 30, wherein the damascene opening further comprises a trench above the via.

32. The process as claimed in claim 31, wherein the metal filling step includes filling copper or copper alloy in the trench and the via.

33. The process as claimed in claim 26, wherein the first metal layer is copper or copper alloy.

34. A process for forming a metal damascene structure, comprising the following steps:

forming a cap layer on a first metal layer;

forming a dielectric layer on the cap layer;

forming a photoresist pattern on the dielectric layer, wherein the photoresist pattern contains carbon;

etching the dielectric layer using the photoresist pattern as a mask to form a damascene opening;

plasma treating using an oxygen-containing plasma; and

filling a metal in the damascene opening.

35. The process as claimed in claim 34, wherein the etching step uses fluorine-containing plasma or chlorine-containing plasma.

36. The process as claimed in claim 34, wherein the oxygen-containing plasma is N_2O plasma or oxygen (O_2) plasma.

37. The process as claimed in claim 34, wherein the damascene opening is a via.

38. The process as claimed in claim 37, wherein the damascene opening further comprises a trench above the via.

39. The process as claimed in claim 38, wherein the metal filling step includes filling copper or copper alloy in the trench and the via.

40. The process as claimed in claim 34, wherein the cap layer is nitride or silicon carbide.